# Lifetime improvement with LEACH Protocol

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***Abstract* :-** Contemporary growths in the field of microelectronics and network communications which make it achievable to organize in a wide range of Wireless sensor network. These sensor networks have recently come into prominence because they have hold the potential to revolutionize many segments. As we know that wireless sensor network suffers from excessive packet loss, over hearing, retransmission of the packet due to node mobility and constant energy dissipation. Routing protocol techniques is one of the research area in wireless sensor network. So by crafting an efficient routing algorithm to improve the network lifetime. In this paper, we are drawing a new technique for cluster-head selection by analyzing the lasting energy of the node and also considering the type of communication between the nodes and cluster-head. This technique is compared with the conventional LEACH. The work is simulated in MATLAB, and the result will shows increasing in the network lifetime by increasing the number of alive node and decreasing the number of dead node.

***Keywords*—*WSN, LEACH, lifetime, hard-threshold, soft-threshold, lasting energy.***

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## I. INTRODUCTION

Wireless sensor network is a network consisting of several number of homogeneous nodes named as sensors nodes which are spatially disseminated all over the locality. It also includes sensor nodes, sink node and management node, large number of sensor nodes are deployed in the monitored area, creating a network through the way of self-organizing. These networks are used to monitor physical or environmental conditions such as temp, pressure, sound, vibration at these locations. Wireless communication empowers the co-operation of nodes to fulfill bigger tasks that sole node cannot. Nodes in WSN are densely organized and are greater in numbers as compared to mobile ad hoc networks. These nodes sense the vibration and gather all the information and communicate with each other and pass information along from one to each other from source to base station. [1]. Recent encroachment in micro-electro-mechanical system (MEMS) technology, digital electronics and wireless communication had enabled the improvement of low-power, low-cost, multi-functional sensor nodes that are small in size, and communicate released in short distance. A sensor network is subject to a unique set of reserve constraints such as finite on-board battery power and limited network communication bandwidth. In the typical sensor network, each sensor nodes operates released and has a microprocessor and a small amount of memory for signal processing and task scheduling. Each sensor node communicates wirelessly with a few other local nodes within its radio communication range. [2]

WSN have enormous potential because they expand human ability to monitor and interact remotely with the physical world. Smart sensors are able to collect enormous amount of previously unknown data, which have the way for a new class of computing applications. Sensors can be organized and accessed remotely where it is not viable to lay data and power lines. Random dissemination of the node in the sensing field makes battery recharge or exchange an impossible facts.

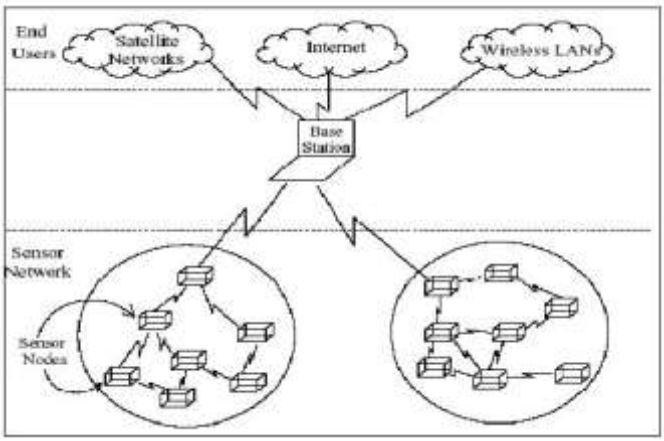


Fig.1: Wireless Sensor Network [4]

WSN technology has been proven to have a Strong influence on our daily life from many applications. WSN enable the reliable monitoring of a variety of environments for Application that include Structural Health Monitoring, Industrial Automation, Civil Structure Monitoring, Precision agriculture, Glacial Environment Monitoring, Planet exploration, Food Industry, Aircraft, Habitat Monitoring of animals, Fire Rescue Applications, Bathymetry, Ocean Water Monitoring, Environmental monitoring, Home security, Logistics control, Machine failure diagnosis, Chemical, Biological detection, Medical monitoring, Battle field surveillance, Machine failure diagnosis, Biological detection, Inventory tracking, Asset management, Traffic surveillance.

## II. BACKGROUND

Nandakishor Sirdeshpande [5] has lifetime maximization using modified leach protocol for energy efficient routing in wireless sensor network (WSNs). As they know that Wireless sensor

network suffers from over hearing, excessive packet loss, retransmission of the packets due to node mobility and constant energy dissipation. A current technique for routing and data transmission does not take into account of optimizing the transmission through Energy Balancing. There are many several power and energy aware algorithms that entitlement to reimburse for the energy losses. The foremost fundamental of most of the techniques is to route the packets through the highest energy nodes which lead to quick battery drainage of those node.

In Sonu Vashist [6] has performed Enhanced leach protocol to increase network lifetime. To maximize network lifetime, they should consider a trade-off between total energy consumption and energy balancing among sensors. In cluster-based routing in wireless sensor network WSNs, there is one sensor called as CH which acts as router or gateway. All non-CH nodes transmit their data to their CH, which routes it to the remote PN. However, since Cluster Heads chomp more energy in aggregating and routing data. They presented an optimal allocation of states to sensors node which maximizes the efficiency of sensors' energy.

In S. H. Gajjar [7] has studied about Low Energy Adaptive Clustering Hierarchy (LEACH), is well referred protocol architecture for WSNs. To save energy, they further propose to start the steady state operation of a sensor node only if the value sensed by a node is greater than the set threshold value. The threshold value will be set by the end user at the application layer. Improved-LEACH is then qualitatively and quantitatively examined. The quantitative and qualitative metrics presented for comparison framework can be used to analyze tradeoffs produced by different wireless sensor network (WSNs) protocols.

## III. LEACH PROTOCOL

In order to extend the network lifetime, many routing protocols have been devised. One of these is network clustering, in which network is partitioned into small cluster and each cluster is monitored and controlled by a node called cluster-head.

LEACH stands for Low-energy adaptive clustering hierarchy. It is first proposed by Wendi B. Heinzelman[3] in the year 2000. It is a clustering-based protocol that minimizes energy dissipation in sensor networks. The reason we need these type of network protocol such as LEACH is due to the fact that a node in the network is no longer useful when its battery dies. This protocol allow to planetary out the lifespan of the nodes, allow it to do only the minimum work, when it needs to transmit data. The main determination of leach is to randomly select sensor nodes as cluster-heads, so the high-energy dissipation during the communication with the base station is spread to all sensor nodes in the sensor network.

The LEACH Network is made of nodes, some of which are called cluster-heads. The job of the cluster-head is to collect data from their surrounding nodes and pass it on to the base station. LEACH is dynamic because the job of cluster-head rotates. LEACH protocol provides a round concept. Each round consist of two phase.

The working of LEACH protocol is working in two phases:

Each round begins with a set-up phase, in which clusters are organized. Then there is a steady state phase, in which data is transferred to the base-station. LEACH is a milestone in a clustering protocol in wireless sensor network with its simplicity and efficiency. However there are some limitation which make LEACH not so effective.

At the beginning of each round, each sensor node choses a random number between 0 and 1, and compares it with a threshold $T(n)$. If the number is less than $T(n)$, the node becomes a cluster-head in current round.

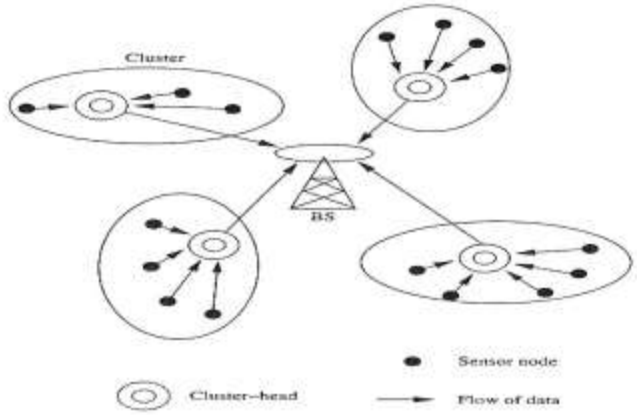


Fig.2: LEACH Protocol [3]

The threshold is set as:

$$T(n) = \frac{p}{1 - p * \left( r * mod\left(\frac{1}{p}\right)\right)} \qquad if\ n \in G$$

Where $p$ is the probability of the node being selected as a cluster-head node, $r$ is the number of rounds, and $G$ is the set of nodes that have not been cluster-heads in the last $1/p$ rounds, *mod* denotes modulo operator. Nodes that are cluster-heads in round r shall not be selected in the next $1/p$ rounds.

Steady State Phase- In steady state phase data transmission begins. The member nodes of cluster send their sensed data to the Cluster Head node in its TDMA slot. After the computation and data aggregation the cluster head send it to the base station.

## IV. PROPOSED ALGORITHM

In this paper we propose a new routing technique called advance LEACH based on the efficient selection of cluster-head scheme & considering the type of communication between within the cluster. Due to the fact that clustering protocols chomps energy, and these protocol increase widespread reception in many application. By considering sensor network model:

Here we had arranged base station in the middle of the detecting zone. Sensor node and base station are not movable. Here we use homogenous sensor network with same computational detecting experiences. Each sensor is assigned with a distinctive identification number (ID). In our planned algorithm, we use homogenous sensor node that dispersed randomly in network area. The probability of a node to become a cluster-head is determined by a threshold T(i). When all the sensor nodes are organized into clusters, each cluster head generates TDMA schedule based time slots for its cluster member nodes. Each attendant nodes transmit their detected information to Cluster Head in its own scheduled time slot. Otherwise nodes will switch to idle mode. Nodes turn on their transmitters at time of transmission. Hence, energy dissipation of individual sensor node decreases by considering the residual energy of the nodes. In this way we can improve the lifespan sensor network.

## V. SIMULATION RESULT

### A. Simulation platform

MATLAB software is used to simulate different routing protocols. MATLAB stands for matrix laboratory is a numerical computing environment and it developed by MathWorks and also it is fourth-generation programming language.

### B. Simulation Setup

The basic simulation parameter for the model are mentioned in table I. The experiment is performed by using the same source energy, the size of a control packet *L*ctrl is 200 bits and senor area field is 100 by 100 sq. meters. The base station placed at (50,50)m.

*Table 1: simulation parameter*

| ***Description*** | ***Symbol*** | ***Value*** |
|---|---|---|
| Number of nodes | n | 100 |
| Initial energy | Eo | 0.5 J |
| Energy consumed by the amplifier to transmit at short distance | Efs | 10pJ/bit/$m^2$ |
| Energy consumed by the amplifier to transmit at longer distance | Emp | 0.0013 pJ/bit/$m^2$ |
| Energy consumed in the electronics circuit to transmit or receive the signal | Etx/Erx | 50pJ/bit |
| Data Packet | K | 4000 bits |
| Data aggregation energy | Eda | 5pJ/bit/report |
| Cluster probability | P | 0.05 |
| Area | Xm* Ym | 100m* 100m |
| Control packet | Lctrl | 200 bits |

### C. Simulations Results

In WSNs, there are a lot of parameters to evaluate a clustering algorithm. In this paper, by increasing the number of alive node and decreasing number of dead node, we can increase the network lifetime and result will compare the performance of the improved algorithm of the proposed algorithm with LEACH. If sensor node's energy is less than zero, we can called it as a dead node. When all node in the network got dead, we can realize the network failure. Figure 4 shows the network establishment of our proposed work in the field of 100m×100m.

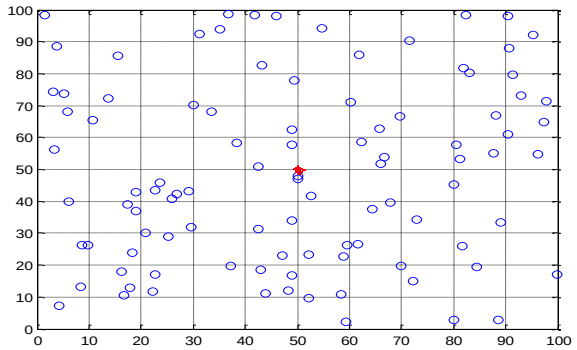


Fig. 4: Network establishment

The simulation results portrayed in Figure 5 shows increase in the number of alive node as compared from the existing LEACH.

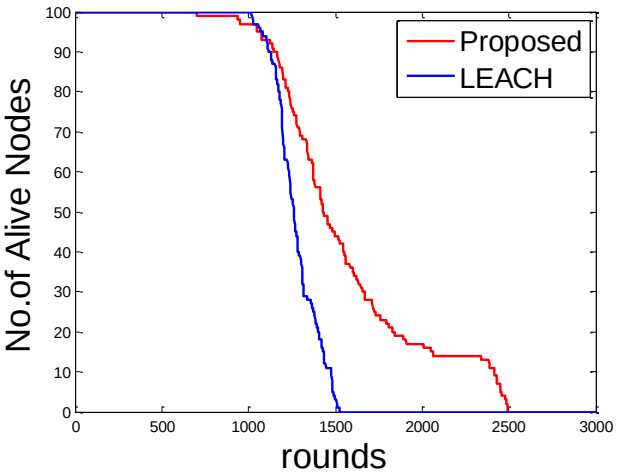


Fig. 5: No. of alive nodes

The simulation results portrayed in Figure 6 shows decrease in the number of dead node as compared from the existing LEACH.

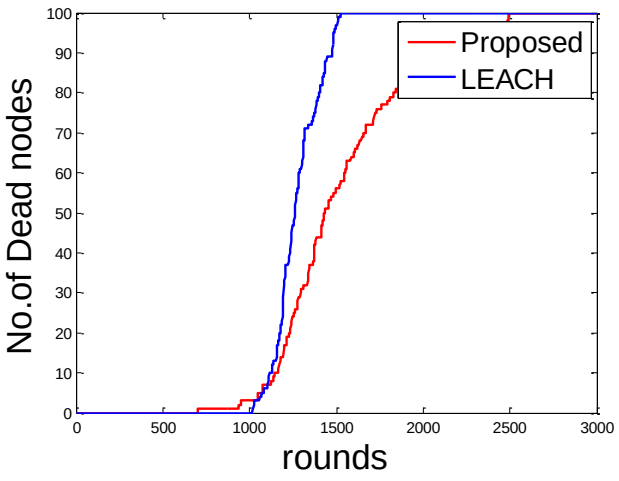


Fig. 6: No. of dead nodes

The simulation results portrayed in Figure 7 shows network lifetime of the proposed work which is compared from the existing LEACH.

From all the simulation result portrayed in the above figures, we can convey that in the proposed work, nodes started dying later due to efficient use of cluster-head selection technique and also by considering the dual amplification energy during the communication between the nodes. So, by performing this experiment proposed method shows increases network lifetime.

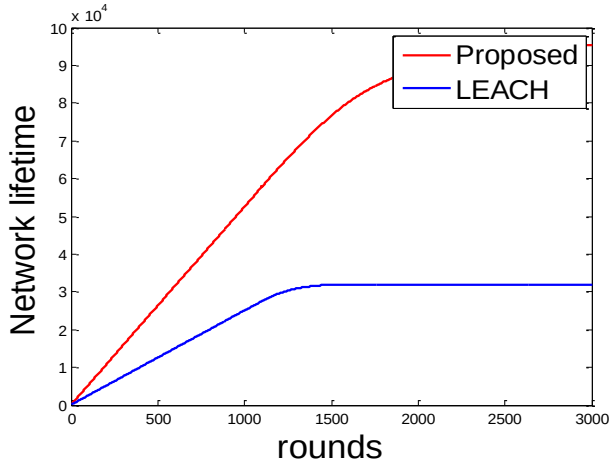


Fig. 7: Network lifetime

## VI. CONCLUSION AND FUTURE WORK

In wireless sensor network, the energy consumption and the network lifetime is important issues for the research of the route protocol. In this project, we had present a novel cluster-head selection algorithm on the basis of lasting energy and mode of amplification energy. Its main idea is to increase lifetime of the sensor network using number of alive node and number of dead node. The simulation result shows that proposed work perform better than LEACH algorithm. In this project, we just adopt the way of selecting cluster head on the basis lasting energy which give the node a chance to become cluster head to accomplish our persistence of increasing the network lifetime.

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